Citrus Industry

THE CITRUS PICTURE

The Florida citrus picture is more gratifying to growers than it has been for many years.

Many factors have contributed to the painting of this picture. The new citrus code has played a worthwhile part; the Florida Citrus Mutual has contributed largely; frozen citrus concentrate has been a prominent factor in the over-all price support; shortage of supply from California and Texas due to unfavorable climatic conditions has helped; the excellence of the Florida crop has been an important factor. All of these factors have contributed to the making of the favorable citrus picture.

But all of these factors cannot be depended upon permanently. The citrus code will be with us for at least another season; the Florida Citrus Mutual (we hope) is a permanent institution; frozen citrus concentrates will continue to be an important factor. But we cannot depend upon nature to favor us year after year at the expense of our competitors.

Continued prosperity for growers depends largely upon the growers themselves, in the production of high quality fruit and continued control of orderly marketing. The present season has demonstrated this beyond question. Realizing this, most growers are determined that henceforth their efforts will be directed primarily to the production of quality fruit and intelligently directed control of distribution.

Vol. 31, No. 3 March, 1950

RIGHT on the Head!

If a fellow were to listen to all the uncorrelated advice and suggestions about feeding and pest control in groves these days, he would be confused indeed. And it is hard to know what program of grove care to follow to get the best quality fruit at the lowest possible cost.

Many of our customers tell us that by calling the Wilson & Toomer Representative, they can solve many of their problems all at once through completely organized and related planning. That stands to reason because the Wilson & Toomer man is a trained citrus man. Back of him is one of the most progressive research programs in the business. To hit the nail right on the head and get a program that is right for you, call your Wilson & Toomer man!

IDEAL

WILSON & TOOMER
FERTILIZER COMPANY

JACKSONVILLE, FLORIDA

The Insect Outlook And Spray Recommendations For March, 1950

J. T. GRIFFITHS, JR., AND
W. L. THOMPSON

Spring has already arrived in the citrus growing areas and in some places a crop has been set and post-bloom spray operations are in progress. In groves where water has been adequate, bloom is appearing in some quantity. The bloom may be somewhat irregular from grove to grove but this will allow post-bloom spray operations to be spread over a greater interval than is sometimes the case. For best melanose control, use copper 1-3 weeks after petal fall. A number of different insect problems present themselves at this time and they will be discussed in seperate sections below.

Scale Insects

In general, increase in purple scale infestations have not been very large during the fall and winter months. On the other hand, Florida red scale populations have increased materially since December and are present in threatening proportions in many groves at the present time. In general, scale infestations are much lower this spring than they were a year ago. This means that growers will start the 1950 season with less scale and with less potential scale injury than they have experienced for some years. However, with red scales as threatening as they are in some groves scale control measures will be needed by some growers at this time. Several different possibilities for scale control are offered this year.

In the past, oil sprays or copper-oil sprays have been used at this time of year. Certain precautions regarding the use of oil or copper-oil should be made. In planning this type of program, copper-oils should be applied as soon after petal fall as possible in order to prevent copper injury. Post-bloom oils should be applied before the fruit measures 3/4 of on inch in diameter. If desired, oil sprays may be used before bloom without injury to young growth. Since groves are generally dry at this time, it should be ascertained that moisture is satisfactory where oil sprays are to be used.

Some growers will wish to use parathion as a part of their scale control program in 1950. Complete precautions and suggestions for its use have been issued with the Better Fruit Program from the Florida Citrus Commission. Anyone planning to use parathion should be thoroughly familiar with all precautions and should strictly adhere to them. All precautions have been made with a definite purpose in mind and no precaution should be excepted when parathion is to be used. Under no circumstances

(Continued on page 16)

Hamlin vs. Parson Brown

On Rough Lemon Stock

We give below this season's record on 10 acres of Hamlin Oranges, and 10 acres of Parson Brown Oranges, on the same root stock, in the same grove planted and owned by Lake Garfield Nurseries Co., both being the same age and having had the same care and fertilizer from the beginning. Both groves are 16 years old.

HAMLIN --- 10 Acres:

2083 Boxes Packed and Shipped Nov. 1949, Net on Tree		$1,991.70
3267 Boxes Sent to Cannery Nov. & Dec. 1949, Net on Tree		5,553.90
5350	Totals	$7,545.60

PARSON BROWN --- 10 Acres:

1868 Boxes Packed and Shipped Nov. 1949, Net on Tree		$1,723.22
3433 Boxes Sent to Cannery Nov. & Dec. 1949, Net on Tree		5,836.10
5301	Totals	$7,559.32

LAKE GARFIELD TREES mean better yields of quality fruit. The reason more of the above fruit went to the cannery, was due to to prospects for more money per box, and this proved justified.

We are at your service, but trees are getting scarce

Lake Garfield Nurseries Co.

P. O. Box 154 T

Bartow : Florida

Office Opposite Postoffice Phone 460; Night 306 or 582

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A Comparison Of The Mineral Composition Of Valencia Orange Leaves From The Major Producing Areas Of The United States . . .

WALTER REUTHER, PAUL F. SMITH AND ALSTON W. SPECHT
U. S. DEPARTMENT OF AGRICULTURE, ORLANDO, FLA., AND BELTSVILLE, MD.

Very little is known concerning the comparative mineral composition of citrus foliage in the several producing regions of the United States. The data available from various sources (5, 7, 8) make strict comparisons difficult because of variations in sampling methods, age of leaves, and other factors. The data considered in this report were obtained with a view to obtaining additional background information of value in establishing the relation between leaf composition and vigor and fruiting behavior of citrus plantings. These analyses are of foliage samples collected in 1947 and 1948 from commercial Valencia orchards. This is a major orange variety in all citrus growing regions of the United States.

Methods

Most of the Florida samples were obtained in orchards on the acid, very sandy soils of the central part of the state. No samples were collected from groves located in the more fertile but less perfectly drained soils of the coastal citrus regions. Usually 3 leaf samples, consisting of 36 leaves each, were collected in each grove or portion of a grove sampled. One median leaf was harvested from each of six non-fruiting, spring-flush shoots distributed around each tree in a zone 3 to 7 feet from the ground level. Shoots supporting summer-flush leaves were avoided. Six trees in a compact group were used for each sample.

The western samples were obtained in a similar manner, except that only one sample was obtained from each planting in most cases, and this consisted of about 100 leaves, usually composited from about 10 trees. The samples were washed, dried, and analyzed for the major nutrients in a manner described elsewhere (16). The trace elements and sodium were determined by spectrographic means using a D. C. arc, complete burning and comparison standard technique (6). Zinc was determined by the A. O. A. C. method (1).

Experimental Results

The Florida Valencia orchards represented in table 1 were, with a few exceptions, mature, bearing blocks which produced satisfactory to very good crops in the three years immediately preceding sampling. It is felt that these represent a rough cross-section of mature commercial groves in the sandy soils in the central part of the state in which an effort was made to maintain a high level of productivity. They include a wide variety of fertilizer and other cultural practices. Almost all were on Rough lemon stock.

The plantings represented by the California samples are from a wide range of climatic and soil conditions, but of course are not numerous enough to be considered a cross-section of California conditions. Nevertheless, the ranges of major nutrients found by Chapman (4) in "high performance orchards" do not differ widely from those found by us in this very limited sampling. Likewise, the samples obtained in Arizona and Texas are limited in number, but we believe that they were selected in a manner which should portray at least a rough indication of the mineral status of

the foliage of Valencia oranges in those regions.

The samples obtained in the Phoenix area of Arizona were from trees that had been more or less damaged by a freeze which occurred on February 13, 1948. Orchards which had been severely damaged were avoided, but samples were obtained from some orchards which had been partially defoliated by this freeze.

Comparisions of the summarized data in table 1 suggest that the Florida leaves are in general heavier than those from the western citrus regions, but that large leaves may be found in all regions. In the orchards sampled, the nitrogen level was general higher in Florida than in the West. The very low level of nitrogen reflected by the Arizona samples is probably due in part to the practice in the Yuma area of applying nitrogen in the fall and winter months only, and inducing a low nitrogen level in summer and winter to improve fruit quality by growing non-legume cover crops (11). The samples from the Phoenix area, though somewhat higher in nitrogen than those from Yuma, are perhaps lower than normal because of the reluctance of some growers to purchase fertilizers for spring application in the face of loss of revenue resulting from frost damage to a large portion of the 1948 Valencia crop, and reduced prospects for the 1949 crop. The very high N level in Florida may be in part a reflection of the predominance of Rough lemon rootstock in this region (18).

A very striking contrast in foliage composition occurs in the case of calcium and potassium. The average percentage of calcium in the Taxas samples was about 50 percent greater than that found in the Florida samples. The calcium content of California and Arizona samples occupied an intermediate position. If these leaves had been harvested a month or so later, they would have been more nearly comparable in age to the Florida samples, and it is probable that the levels found would have been closer to those found in Texas and to the range found in California by Chapman. As fully developed leaves become older, the calcium concentration increases, and potassium decreases (16). No doubt the high calcium level in leaves is a reflection of the calcareous nature of many of the western citrus soils. This relatively high calcium concentration in the soil probably accounts in part for the relatively low potassium content found in the samples from Texas and California, which amounted to only about one-half the level found in the Florida samples. Foliage samples from Arizona contained an intermediate concentration of potassium. Again, the levels in the western samples would have been somewhat lower if the samples had been collected a month or so later.

There is very little difference in the range of phosphorus concentration in leaves from the four regions studied, although Texas samples average a little lower. The magnesium levels in leaf samples in Florida, Arizona, and Texas are somewhat higher than those from California. Some in California are near the critical level suggested by Chapman (4). Whether the relatively high levels found in a few Florida and Arizona samples are desirable or not remains to be determined by future studies.

The sodium concentration in citrus leaves is not high. In Florida, samples which had more than 0.07% were obtained from orchards which had been irrigated with water from salty wells. In Texas, samples having values near the upper range of sodium concentration were in most cases but not all, from low vigor orchards located on poorly drained, saline soils. The low sodium level prevailing in the California samples is probably another reflection of the repressive effects of a high calcium concentration on the uptake of other bases in non-saline soils.

Some rather striking differences among the several regions are indicated by the trace element data obtained. In the case of the copper content of the Florida samples, the results divide themselves into two groups—those that contain between 5 and 10 p.p.m. (25 samples) and those that contain between 17 and 64 p.p.m. (10 samples). Because of the probability of incomplete removal of copper spray residues by the washing technique used, the values in this latter group are suspected of being too high because of this surface contamination (17), and were not included in the range presented in table 1. Thus it seems reasonable to postulate that if methods could be devised to effectively remove copper spray residues

Table 1. Summary of analyses of Valencia orange foliage from Florida, Texas, Arizona and California orchards

Region and No. locations sampled	Age of leaves, mo.		Mean dry wt. per leaf, mgm.	Major foliage constituents, percent in dry matter						Trace elements, p.p.m. in dry matter				
		Range		N	P	K	Ca	Mg	Na	Zn	Cu	Fe	Mn	B
Central Florida 37 locations	4 to 5½	Max.	336	3.00	0.159	2.20	5.50	0.510	0.091	30	10.2	102	85	305
		Min.	231	2.15	0.111	0.95	2.32	0.293	0.035	16	5.0	36	20	33
		Mean	285	2.66	0.139	1.56	3.44	0.390	0.049	21	7.2	61	37	92
Texas, 11 locations	3½	Max.	357	2.50	0.147	1.18	5.90	0.355	0.171	26	11.0	105	48	239
		Min.	181	2.02	0.100	0.46	3.28	0.264	0.034	18	6.7	40	11.6	55
		Mean	252	2.30	0.120	0.73	5.14	0.318	0.089	22	9.2	69	28	118
Arizona, 17 locations	2½ to 3	Max.	273	2.68	0.165	1.65	5.40	0.640	0.144	25	11.4	47	34	294
		Min.	164	1.82	0.115	0.72	2.38	0.264	0.021	8	5.4	18	7.1	47
		Mean	216	2.16	0.145	1.22	4.24	0.351	0.035	15	9.0	36	12.8	108
California, 10 locations	2½ to 3	Max.	306	2.75	0.165	1.53	4.80	0.328	0.027	33	10.1	64	17	87
		Min.	168	1.92	0.115	0.31	2.69	0.180	0.020	8	5.1	30	8.7	30
		Mean	234	2.42	0.140	0.71	3.95	0.265	0.023	18	7.8	45	12.5	57
California, Chapman data [1]	3 to 7	Max.	—	3.16	0.182	1.12	5.52	0.40	0.10	80	10	200	80	100
		Min.	—	2.00	0.092	0.38	3.00	0.20	0.02	20	4	70	20	20
		Mean	—	2.45	0.130	0.71	4.70	0.30	0.06	30	7	120	30	30

[1] From data of Chapman (4) obtained from "high performance orchards."

from leaves, analysis would indicate about the same range of copper content in all the citrus regions. No copper deficiency symptoms were noted in any of the orchards sampled in any of the regions.

The iron values are lower than those foud by Chapman (4,5) and by others (8). This is probably due to the efficacy of the washing technique used in this study in removing surface iron contamination (17). All the samples in Arizona and most in California are below the critical iron level suggested by Chapman (4), while most in Florida and Texas are above.

In central Florida manganese salts are regularly applied in mixed fertilizers to most citrus plantings at a rate between 20 and 30 pounds of MnO per acre per year. The use of manganese salts as a soil treatment in western orchards is not a common commercial practice, but manganese nutritional sprays are used to some extent, particularly in California. So far as we were able to determine, none of the western orchards sampled had been recently sprayed with manganese. The data indicate that there was on the average about twice as much manganese in the Florida orchards sample was from a portion of an California. The Texas orchards sampled had an intermediate level of manganese. The lowest manganese content found in a Texas sample was from a portion of an orchard affected with chlorosis, but the symptoms were not those commonly associated with manganese deficiency (5), but rather those associated with "iron chlorosis" (5). No typical symptoms of manganese deficiency were noted in any of the western orchards sampled, but two Florida orchards showed typical symptoms. These had the lowest manganese levels (20 p.p.m.) among the Florida samples, but were much higher than most California and Arizona samples which showed none. The critical level suggested by Chapmon is 15 p.p.m .

The boron level in the orchards surveyed varied through a wide range. A few in Texas and Arizona and two in Florida were somewhat above the excessive level of 200 p.p.m. suggested by Chapman. Just what damage to tree vigor and fruitfulness is associated with boron levels of 200 to 400 p.p.m. has not yet been determined with certainty. While some of the boron levels in Florida and California were somewhat low, none was so low as to be in the range usually associated with definite symptoms of boron deficiency (4,5).

Some of the zinc values obtained on the Florida samples were so high as to suggest imperfect removal of zinc spray residues, and these, like the high copper values, were not included in the range presented in table 1. The zinc data show that this heavy metal, like manganese and iron, tends to be lower in the Arizona and California than in the Texas and Florida samples.

Discussion

With most decidous fruit plants, a level of potassium nutrition reflected by 1.0 to 1.5 percent or more of potassium in 3 or 4-month-old leaves is associated with satisfactory productivity and vigor. Below this level, vigor and productivity is likely to be subeptimal (8). These criteria are based primarily on field experiments conducted in the predominantly acid fruit soils of humid regions. The published data available relating leaf composition to yield and growth in well designed field fertilizer experiments are less extensive for citrus than for deciduous fruits. Hass (9), working in California, found symptoms of potassium deficiency in sand cultures and commercial citrus orchards associated with a potassium concentration in leaves below about 0.35 percent. Similar observations were made by Arnot (2) in Australia, but the symptoms described differed somewhat. Chapman (4) tentatively concluded from greenhouse and field studies in California that 3 to 7-month-old orange leaves containing less than 0.4 percent of potassium probably indicated potassium deficiency, but that it was rather doubtful if response to potassium would be obtained in orchards with values higher than 0.4 percent. He found that the "high performance orchards" surveyed had potassium levels ranging between 0.38 and 1.12 percent.

In summarzing field fertilizer studies that were carried out over a period of years on various soild types in California orange orchards, Parker and Batchelor (12) concluded that applied potassium was of no value in improving yield or fruit quality. No potassium analysis of leaves are presented, but they state that some analyses were made which indicated that potassium fertilization did increase the uptake by the trees. Working with Marsh grapefruit on the deep, sandy soil of the Yuma Mesa of Arizona, Finch and McGeorge (7) concluded that potassium fertilization alone or in combination with other nutrients did not affect fruiting behavior. However, the leaf analyses presented indicated that the potassium level was relatively high in all treatments. It ranged between 2 and 4 percent in dry matter in spring-flush leaves hervested in June.

The studies of Bahrt and Roy (3) in Florida indicated that reduced yield and small fruit sizes resulting from omitting potash from the fertilizer for a number of years in a Florida orange grove was associated with a level of 0.87 percent of potassium in the leaves, while all plots receiving potash in the fertilizer had a level of leaf potassium of 1.26 percent or more. However, the age of leaf sampled is not indicated but the associated calcium values suggest they were about 1 year old, judging by studies made on similar acid, sandy soils (16). Thus the levels in both treatments probably would have been somewhat higher had younger leaves been sampled. In Jamaica, Innes (10) concluded from analysis of leaves from field fertilizer plots with grapefruit that about 1.16 percent of potassium in leaves is the minimum adequate level for satisfactory production. Again, details concerning age of leaf sampled are lacking. Reporting one season's results with field fertilizer trials in Florida, Reuther and Smith (13) noted that a moderate increase in orange yield and fruit size was produced by increasing the level of potash fertilization. This was associated with a range of potassium in 4-month-old spring-flush leaves well above 1 percent.

Thus the data available tend to agree that when the potassium level in citrus leaves falls below 0.4 percent, deficiency symptoms are likely to occur. However, there is little agreement as to where the critical level of potassium concentration in citrus leaves is, from the standpoint of economic fruit production. The California workers suggest far lower critical levels than are indicated by the scant data available for Florida and Jamaica. The absence of a well-defined leaf symptom with citrus, such as leaf-scorch of deciduous fruits, unless potassium deficiency is acute, has probably contributed to the confusion. The

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The Role Of Micro-Organisms And Storage Temperatures On The Quality of Orange Concentrate[1]

Roger Patrick
U. S. Citrus Products Station [2]
Winter Haven, Florida
at Meeting
Florida State Horticultural Society

An estimated volume of ten million gallons of concentrated orange juice was prepared by Florida's frozen concentrate plants last season. Frozen concentrate holds a favored position among the citrus fruit products manufactured by the plants in Florida and has won an enviable place among the consumers of frozen foods. This huge and rapidly growing industry must use every means to safeguard its product.

Many factors are of importance for the production and marketing of frozen orange concentrate of the best quality, such as the selection of fruit of good flavor and proper maturity, control of the Brix-acid ratio, rapid handling of the fruit, plant sanitation, control of peel oil, and suspended solids content. Another important factor is the maintenance of proper temperatures during storage, transportation, and distribution of the product. This discussion is concerned with observations on the effect of storage temperatures above freezing in causing deterioration of the concentrate. The containers generally carry specific instructions as to the frozen storage temperature—usually to the effect that the product must be keep frozen until used. Laxness in this respect during storage or on the part of the distributor, retailer or consumer would tend to mar the superior quality of this delicious product. The present paper is a report merely of microbiological examinations of samples of Florida orange concentrate, made at room temperature before storage and after storage at different temperatures and for different periods with the object of determining the relation between microbiological activity and the time and temperature of storage; as well as the role of each in affecting the quality of the product. The minimum temperature required to inhibit growth in stored concentrate was not determined in this study.

The specimens of concentrate used in this study were collected from each of the Florida plants producing orange concentrate at intervals during the 1948-49 season, packed in crushed ice, and taken to the laboratory. One specimen was used for plating as soon as it arrived; one was packed in the "zero room" (approximately -2° F.) and when a third specimen had been collected, it was placed beside the cooling unit in an electric refrigerator 42° F. to simulate storage conditions found in many households and frequently observed in holding cabinets of retail stores. Since the refrigerator employed in this study was one in general use and was opened many times during the day, the conditions of the experiments further approximated those of food storage in a household refrigerator when storage outside of the freezing compartment was used. Even with the frequent opening of the refrigerator, the temperature was never observed to rise above 48° F.

The concentrate was diluted and 1 ml. of 1:1000 was inoculated into each of four media: Lindegrin's agar, pH 5.8; dextrose tryptone agar pH 7.4; tryptone glucose extract agar, pH 7.0; and Sabauroud's dextrose agar, pH 6.2. These media were selected for comparative purposes because each industrial laboratory in the Florida citrus producing area prefers at least one of the media for total count determinations. At a later period in the study when puffed cans or swells were found among the specimens stored at 42° F., a 10% sucrose

Table 1. Analysis of freshly prepared frozen concentrate. Number of organisms per ml. calculated to reconstituted juice basis. [1] Inoculations: 1 ml./1:1000 of concentrate.

Sample	Plant	Lindegrin's agar	Dextrose tryptone agar	Tryptone glucose extract agar	Sabauroud's agar	Processing date
1	D	7 ppl	4,200	9 ppl	4,280	2/1/49
2	E	416,620	400,000	350,000	43,330	2/4/49
3	B	79,520	84,290	70,950	63,330	2/8/49
4	E	89,520	34,290	63,330	43,090	3/8/49
5	G	2,860	3,330	2,380	7 ppl	3/11/49
6	H	25,470	31,190	21,660	27,620	3/15/49
7	I	7,860	9,760	6,190	8,090	3/17/49
8	C	15,940	11,910	13,330	17,860	3/18/49
9	L	32,290	35,720	34,570	33,710	3/25/49
10	G	27,140	29,520	25,000	34,290	3/31/49
11	B	55,238	57,620	54,760	50,480	4/1/49
12	I	19,760	7,860	7,140	9,050	4/8/49
13	E	25,000	sp [2]	sp [2]	41,660	4/22/49

[1] Number per plate is given when organisms surviving were ten or fewer and were not calculated to a reconstituted juice basis.

[2] Spreaders.

[1] Agricultural Chemical Research Division Contribution No. 251.

[2] One of the laboratories of the Bureau of Agricultural & Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.

citric acid yeast-extract agar, pH 3.8, was also employed. This medium simulated osmophilic and pH conditions comparable to those found in the substrate of the puffed cans. Microscope slide checks were made at the time the colonies were counted, tabulations of the results were not made, and only general statements referring to them will be given.

Table 11. Concentrate after storage at 0° F. Numbers of organisms per ml. calculated to reconstituted juice basis. Inoculations: 1 ml./1:1,000 of concentrate.

Sample	Plant	Lindegrin's agar	Dextrose tryptone agar	Tryptone glucose extra agar	Sabauroud's agar	Storage time	Processing date
1	D	0	0	1 ppl [1]	1 ppl	198 days	2/1/49
2	E	4,762	4,290	5,952	4,290	195 days	2/4/49
3	B	3 ppl	2 ppl	10 molds ppl	2 ppl	191 days	2/8/49
4	E	0	3 ppl	3 ppl	3 ppl	143 days	3/8/49
5	G	2 ppl	4 ppl	2 ppl	8 ppl	142 days	3/11/49
6	H	7 ppl	6 ppl	4 ppl	6 ppl	136 days	3/15/49
7	I	3 ppl	1 ppl	1 ppl	1 ppl	134 days	3/17/49
8	C	5 ppl	1 ppl	5 ppl	4 ppl	133 days	3/18/49
9	L	0	0	0	0	128 days	3/24/49
10	G	3,571	2,619	4,290	3,095	121 days	3/31/49
11	B	4 ppl	2 ppl	3 ppl	3 ppl	120 days	4/1/49
12	I	1 ppl	0	1 ppl	4 ppl	115 days	4/8/49
13	E	4 ppl	2 ppl	4 ppl	4 ppl	111 days	4/22/49

[1] Number per plate (ppl).

Results

The data from the initial analyses —made before storage of the samples—calculated to a reconstituted juice basis are listed in Table 1. The initial analyses show that the concentrate contained infestations of organisms ranging from moderate to very high in number; microscope slide observations indicate that yeasts constituted the principal contaminant.

Table II gives the results of analyses of samples held in the zero room and Table III of those in the zero room for 195 days, and another for a period of 120 days retained a viable cell count of some signifiance. These two specimens, Nos. 2 and 10, contained sufficient yeast population to cause spoilage if the storage temperature had been allowed to rise or the concentrate to remain at room temperature for a few hours. Specimen No. 10 retained about 4,000 live cells per ml. of reconstituted juice after a period of 120 days. Sample No. 2 contained a moderately heavy infestation of yeast cells the day it was collected but the number of yeast cells surviving zero room storage after 195 days was about 5,000 per. ml. of reconstituted juice. Growth did not appear on plates inoculated with concentrate from sample No. 9 after storage period of 128 days. The remaining samples produced very low counts (reported as numbers per plate). Some of these low count specimens were given a reversed rating when they were first analysed (Table I); one in particular, No. 2, contained a count of 400,000 per ml. of reconstituted juice.

After the storage times listed in Table III, the samples were removed from the refrigerator and plated. The procedure and media were the same as those employed during the initial plating, except for the two samples that showed signs of spoilage.

The container of conecntrate, No. 4 (stored at 42°) was a hard swell; the other, No. 11, was badly puffed. In addition to the other media used these two samples were plated on a 10 percent sucrose citric acid yeast-extract medium, pH 3.8. The inoculum was diluted 1:10,000.

Formula:

Sucrose	10%
Citric acid	0.5%
Yeast extract	5%
Potassium monobasic phosphate	0.001%
Peptone	0.003%
Agar	1.5%
Distilled water	

Inoculations of sample No. 4 produced high counts on dextrose tryptone agar and on tryptone glucose extract agar. The 1 ml. inoculation of 1:10,000 dilution on 10 percent sucrose citric acid yeast-extract agar was seeded too heavily, the colonies were too close together, and were so small that it was impossible to obtain a count (Table

Table III. Concentrate stored at 42° F. Numbers of organisms calculated to reconstituted juice basis. Inoculations: 1 ml./1:1,000 of concentrate.

Sample [1]	Plant	Lindegrin's agar	Dextrose tryptone agar	Tryptone glucose extract agar	Sabauroud's agar	Storage time	Processing date
4	E [2]	5 ppl [3]	26,190	35,714	4 ppl	143 days	3/8/49
5	G	1 ppl	0	1 ppl	0	142 days	3/11/49
6	H	Sample lost					3/15/49
7	I	6 ppl	1 ppl	4 ppl	4 ppl	134 days	3/17/49
8	C	1 ppl	1 ppl	3 ppl	5 ppl	133 days	3/18/49
9	L	1 ppl	0	1 ppl	2 ppl	128 days	3/24/49
10	G	5,714	3,309	5,477	8,332	121 days	3/31/49
11	B [4]	7,619	7,619	7,619	5,952	120 days	4/1/49
12	I	5 ppl	4 ppl	2 ppl	8 ppl	115 days	4/8/49
13	E	6 ppl	2 ppl	5 ppl	6 ppl	111 days	4/22/49

[1] Samples 1, 2, 3 were not collected in triplicate.
[2] Also plated on 10% sucrose citric acid yeast-extract agar, 1 ml./1:10,000; too many to be counted.
[3] Number per plate.
[4] 7,857 per ml. of reconstituted juice

at 42° F. The numbers of organisms, when only ten or fewer per ml. of 1:1000 dilution of concentrate survived, were not calculated to the reconstituted basis. Instead they were tabulated as numbers per plate.

One sample that had been stored

(Continued on page 13)

Citrus Grove Returns Above Operating Costs By Seasons 1931-48 . . .

ZACH SAVAGE
ASSOCIATE AGRICULTURAL ECONOMIST
FLORIDA AGRICULTURAL EXPERIMENT STATION

Operating costs in the study of citrus costs and returns by the Florida Agricultural Extension Service include all cash costs other than interest on borrowed money. However, interest and depreciation on grove equipment and buildings are included. Interest on the estimated investment in land and trees is not considered an operating cost, although it is considered a production cost.

Table 1.—RETURNS ABOVE OPERATING COSTS, 1931-48
Groves Averaging Over 10 Years of Age

Season	Mixed Groves Per Acre	Mixed Groves Per Box	Orange Groves Per Acre	Orange Groves Per Box	Grapefruit Groves Per Acre	Grapefruit Groves Per Box
1931-32	$ 78.56	$ .46	$114.02	$ .82	$ 1.51	$ .01
1932-33	- 7.94	- .06	18.51	.13	- 40.89	- .18
1933-34	20.98	.23	44.43	.40	8.02	.06
1934-35	24.09	.20	49.54	.35	- 5.72	- .02
1935-36	65.23	.57	128.74	.81	- 20.37	- .15
1936-37	89.23	.64	183.84	1.09	74.78	.16
1937-38	26.14	.17	40.97	.21	25.13	.10
1938-39	20.82	.10	57.37	.23	- 39.03	- .10
1939-40	31.94	.17	65.17	.29	45.24	.17
1940-41	51.50	.26	90.82	.40	57.36	.13
1941-42	128.34	.69	193.48	.83	250.99	.59
1942-43	315.34	1.23	424.05	1.48	198.46	.61
1943-44	425.07	1.40	503.32	1.52	297.03	.84
1944-45	336.42	1.50	499.15	1.87	245.70	.89
1945-46	407.33	1.47	712.68	2.05	333.51	.73
1946-47	56.09	.19	121.42	.37	2.66	.01
1947-48	- 21.97	- .07	- 8.02	- .02	- 114.15	- .25
Average	120.42	.61	190.55	.83	77.66	.24

Returns above operating costs is the amount left from fruit after paying operating costs. Seasonal averages per acre and per box of returns above operating costs are shown in Table 1 and Chart 1 for 17 seasons for orange, grapefruit, and mixed groves. Orange groves are groves made up of 90 percent or more orange trees. Grapefruit groves are groves made up of 90 percent or more grapefruit trees. All other groves were classified as mixed groves and averaged 31 percent grapefruit trees for the 17-year period. The mixed grove figures include all groves—including orange and grapefruit groves.

Returns above operating costs dropped from $407.33 per acre in 1945-46 to $56.09 the following season on mixed groves, a drop of 86 percent. Between the same seasons these figures dropped 83 percent on orange groves and 99 percent on grapefruit. Yet there were 8 of the 17 seasons when mixed groves averaged lower returns above operating costs per acre than in 1946-47. Similarly there were 9 seasons when orange groves averaged less returns above operating costs than in 1946-47, and six seasons in the case of grapefruit groves. There were 5 seasons, 1941-46, with income above operating costs exceeding the average for all seasons in each of the 3 groups of groves. These same 5 seasons and one additional, 1936-37, had returns above operating costs per box as high or higher than the respective averages of orange and mixed groves. In the grapefruit groves these 5 seasons exceeded the average for all seasons but the 1936-37 season was less than the average.

The 1947-48 season was the only season in which all 3 groups of groves failed to return operating costs. That was the only season when orange groves averaged in the red. There was one other season, 1932-33, when mixed groves were in the red. There were 5 seasons when grapefruit groves failed to return operating costs.

On a per-acre basis orange groves averaged highest, mixed groves second, and grapefruit groves lowest in returns above operating costs. This was the order for each individual season except three: in 1941-42 grapefruit groves averaged highest and in 1939-41, 2 seasons, averaged second. There were 8 seasons when the average returns above operating costs were less than $100.00 on orange groves,

(Continued on page 14)

Table 2.—PERCENT OF GROVES THAT DID NOT RETURN OPERATING COSTS, 1931-48
Groves Averaging Over 10 Years of Age

Season	Mixed Groves	Orange	Grapefruit
1931-32	20	0	40
1932-33	56	50	100
1933-34	25	13	50
1934-35	35	39	62
1935-36	21	16	89
1936-37	5	2	0
1937-38	31	39	56
1938-39	29	17	75
1939-40	39	41	22
1940-41	10	11	10
1941-42	4	6	0
1942-43	1	4	9
1943-44	*	0	0
1944-45	3	4	18
1945-46	1	0	0
1946-47	26	14	58
1947-48	66	44	89
17-Year Average	21	17	33

* Less than 0.5 percent.

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A COMPARISON OF THE MINERAL COMPOSITION OF VALENCIA ORANGE LEAVES FROM THE MAJOR PRODUCING AREAS OF THE UNITED STATES

(Continued from page 7)

data in this report suggest that either the potassium levels in Florida orchards are maintained unnecessarily high, or that the prevailing potassium levels in California and Texas are too low, unless it is assumed that potassium requirements interact with soil and climatic factors. Of course, the data also suggest an inverse situation regarding the calcium levels. It is possible that subsequent research may show that a lower level of potassium nutrition is adequate to maintain high yield and satisfactory fruit size when the level of calcium nutrition, for example, is high, or when the climate is semi-arid instead of humid, but the majority of the scant evidence now available with tree crops does not suggest that such interactions occur to any marked degree. It seems to us that a more likely hypothesis is that some factor related to high soil calcium, possibly low availability of heavy metals such as iron, manganese, and zinc, or even some factor unrelated to soil calcium, is limiting yield. If this unknown factor could be isolated and corrected, then potassium response in the form of increased yield and fruit size might be obtained in most western citrus orchards having a relatively low level of potassium in leaves.

Slight symptoms of magnesium deficiency were observed in Florida orchards with magnesium levels of about 0.3% or even above, while Chapman (4) suggests that symptoms are not likely to occur above 0.2 percent. Indeed, some California samples were obtained from trees showing no readily recognizable symptoms, yet having magnesium levels about 0.2 or even below (table 2). It is possible that the levels of calcium and potassium (or even other less obvious minerals) in leaves interact with magnesium level from the standpoint of symptom expression. In other words, it is possible that with the pattern of calcium and potassium composition of leaves prevailing in California, magnesium may fall much lower before typical magnesium deficiency symptoms are expressed than is the case with the calcium-potassium status of leaves prevailing in Florida orchards. However, it should not be assumed that significant reductions in vigor and yield do not occur without symptom expression (14,15). The fact that the manganese level may be far lower in California and Arizona orchards without the expression of serious deficiency symptoms on leaves may also result from similar interactions with the pattern of mineral nutrition indicated by leaf composition. Of course, it is possible also that other factors, such as climate, may interact with symptom expression. In the case of the trace elements, improvements in preparation and analytical techniques to reduce contamination and error may resolve some of the apparent discrepancies in the levels associated with the expression of deficiency symptoms.

These speculations conecrning the possible explanations of apparent discrepancies in level of nutrients at which symptom expression or yield reduction may occur, emphasize that the objectives of future research, in our opinion, should be the determination of levels and patterns of nutrients in leaves associated with a wide range of vigor and productivitv. so that relationships to growth and fruiting behavior, in addition to svmptom expression, may be established. To achieve these objectives, it will be necessary to undertake critical field and sand culture studies, using experimental designs which will permit the evaluation of possible interactions between nutrient factors, as well as major effects.

Summary

In the summers of 1947 and 1948 samples were collected of 2½ to 5-month-old spring-cycle leaves from Valencia orange orchards in Florida, Texas, Arizona, and California. These were analyzed for eleven major and trace nutrient elements. Comparison of the data obtained indicates that higher nitrogen, potassium, magnesium, manganese, and iron concentrations and lower calcium and copper were found in Florida samples than those from the other regions. Potassium was lowest in Texas and California, while calcium, sodium, and boron were highest in Texas. Nitrogen was lowest in Arizona. Phosphorus level did not vary widely among the several regions. Iron, manganese and zinc were lowest in California and Arizona. The possible significance of the wide difference in potassium and calcium and certain trace elements in leaves from Florida orchards and those from the western orchards were discussed. It is suggested that in the case of western citrus orchards having a relatively low level of potassium in leaves, failure to obtain response to potassium fertilization is due to some other as yet unidentified factor limiting productivity.

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THE ROLE OF MICRO-ORGANISMS AND STORAGE TEMPERATURES ON THE QUALITY OF ORANGE CONCENTRATE [1]

(Continued from page 9)

II) . Inoculations on the other two media produced low counts and were considered insignificant (reported as numbers per plate). Inoculations of specimen No. 11 produced colonies that were comparable in number on each of the five media. Sample No. 10 did not appear puffed when it was removed from the refrigerator for analysis, but it produced plate counts similar in numbers to those found in No. 11. A microscope slide check of the growth from these three samples indicated that yeasts were the principal surviving organism. It was also evident that the yeast cells in two of these samples were capable of growing in 42 percent concentrate at 42°. Three specimens of concentrate contained a moderately high contamination of yeast when they were first prepared, (Nos. 4, 10, 11, Table I). Sample No. 2 which produced a high initial count (Table I) and retained a moderate yeast population after a zero room storage of 195 days (Table II) was not collected in triplicate; therefore, the effect of storage at 42° F. was not noted. The other samples showed considerable decline in viable contamination at 42° (Table III). Yeast was the major microbiological contaminant when the initial analysis was made on these specimens: this was found to be true also of the surviving organisms in the final analysis.

It will be noted that there were marked reductions in the count of micro-organisms at both zero and 42°. Since the action of the micro-organisms is vastly different at these two temperatures, direct comparisons of the counts between the two temperatures should not be made. However, the survival of substantial numbers at zero indicates the possibility of fermentation should the sample be transferred to refrigerator or to room temperature.

As the samples were removed from zero and 42° storage, they were reconstituted in accordance with the instructions on the label and tasted. In many cases the flavor was superior in the samples that had been held in zero storage. However, the puffed and swelled containers did not emit the odor of alcoholic fermentation or sourness.

When the samples held at 42° F. were reconstituted, the suspended matter and cloud settled rapidly, leaving a clear layer of juice. This was considered evidence of enzyme action. The clarification and curdling of the suspended matter is unsightly and undesirable. Samples stored at zero did not show this clarification.

The yeasts that caused the spoilage of concentrate at 42° F. have not been studied and identified.

Conclusions

The storage of orange concentrate in the zero room for a period of 198 days does not insure the destruction of spoilage oragnisms; however it tended to reduce the numbers. Many samples stored at 42° F. showed a decrease in viable cell count. Certain yeast infestations in concentrate stored at this temperaure will grow and produce spoilage. Enzyme activity continued in samples of concentrate stored at 42°. Yeast predominated among the surviving organisms in concentrate stored both in zero room and at 42°.

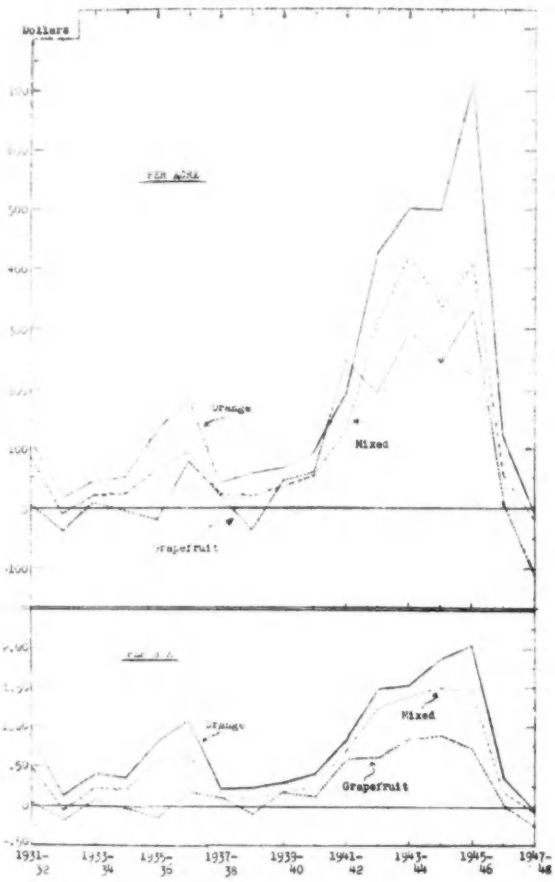
CITRUS GROVE RETURNS ABOVE OPERATING COSTS BY SEASONS, 1931-48

(Continued from page 10)

and 12 seasons each in the case of mixed, and grapefruit groves. The average for mixed groves for all seasons was 63 percent of orange groves and grapefruit groves 41 percent. The season when returns above operating costs were highest was 1945-46 for orange and grapefruit groves and 1943-44 for mixed. The figure for each of the three groups were lowest in 1947-48 when neither group returned operating costs.

On a per-box basis the standing for all seasons was in the same order as per-acre, and in each season the standing was the same except that in 1939-40 mixed and grapefruit groves were the same, 17 cents. There were 7 seasons when returns above operating costs were less than 40 cents per box on orange groves, 9 seasons on mixed and 12 seasons on grapefruit groves. There were 4 seasons when this figure for orange groves was less than 25 cents per box, 8 seasons for mixed and 12 seasons for grapefruit groves. Similarly, there was one season when this figure was less than a nickel on oranges, 2 seasons on mixed, and 7 seasons on grapefruit groves.

Chart 1 — RETURNS ABOVE OPERATING COSTS ON ORANGE, GRAPEFRUIT, AND MIXED GROVES, 1921-48
Groves Averaging Over 10 Years of Age



The average for mixed groves, 61 cents, was 73 percent of orange groves and for grapefruit groves, 24 cents, or 29 percent. The season when returns above operating costs were hig est per box was 1945-46 for oranges, 1944-45 for mixed, and 1943-44 for grapefruit groves. The lowest season for each group was 1947-48.

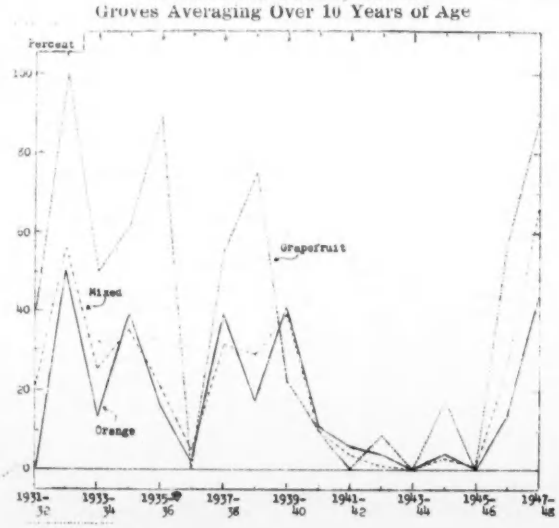
There was considerable difference between the average returns above operating costs per acre for the first 10 seasons and for the succeeding 5 seasons. In the case of orange groves, the figure for the latter period was 6 times that of the former, for mixed groves 8 times, and for grapefruit 25 times. At the rate of returns above operating costs for the first 10 years of this study 31.5 acres of orange grove would be required to return $2,500 to the owner for interest on the grove investment, interest on borowed money, his own supervision, and profit. Likewise, 62.4 acres of mixed or 235.8 acres of grapefruit grove would be necessary to return the same figure. At the rate of returns above operating costs for the 17-year period, 13.1 acres of orange, 20.8 acres of mixed, or 32.2 acres of grapefruit grove would be necessary to return $2,500 above operating costs.

Groves that Failed to Return Operating Costs

A high proportion of individual groves that do not return operating costs is necessary for the average of all groves for the season to be less than operating costs. However, there have not been many seasons

(Continued on page 22)

Chart 2 PERCENT OF GROVES THAT DID NOT RETURN OPERATING COSTS, 1931-48
Groves Averaging Over 10 Years of Age



THE INSECT OUTLOOK AND SPRAY RECOMMENDATIONS FOR MARCH, 1950

(Continued from page 3)

should parathion be used where the fruit will be picked within 30 days. Two possibilities are suggested for parathion programs. For light infestations, use 1 pound of 15 percent wettable parathion per 100 gallons plus 10 pounds of wettable sulfur. If scale infestations are particularly heavy or if mealybugs are present, use 2 pounds of 15 percent wettable parathion per 100 gallons. Neutral copper may be included with parathion and zinc sulfate may be used if only 1 pound of lime is used per 3 pounds of zinc sulfate. DN may also be used if needed for mite control. Where borax is desired with parathion, use it at 1 lb. per 100, but do not neutralize with lime.

Purple Mites

Purple mites have been a major problem throughout the citrus area during the winter of 1949-50. Many growers were forced to spray in early December and mites are returning in those groves. With new growth already appearing, the problem of purple mite control is somewhat complicated. If growth has not started as yet, DN sprays may be safely used. If growth has started DN should not be used until such time as the foliage has hardened up and the crop set. DN sprays may be safely applied at the post-bloom application with the one provision that afternoon temperatures do not exceed 88° F. Past experience has indicated that DN may be safely used in the post-bloom application during the month of March. Any growers that plan to use a DN wettable sulfur combination during March should pay particular attention to afternoon temperatures. While DN-sulfur dusts are not as satisfactory as sprays, they may be used when conditions are not acceptable for sprays.

Another possibility for purple mite control is to use an oil emulsion spray. Where scale insects are not expected to be a problem, only a 1 percent oil emulsion may be used. This should give satisfactory purple mite control. If scale are at all common, use a 1.3 percent emulsion. As noted above these sprays should not be applied where groves are dry.

Six- Spotted Mites

This is the time of year when six-spotted mites move from old foliage to new, and it is often desirable to control them at this time. Control may be effected by using lime-sulfur at 1 gallon per 100 gallons of spray plus 10 pounds of wettable sulfur or with DN-wettable sulfur spray.

Rust Mites

It has been the observation of the authors that, in groves where sulfur has not been used since last fall, rust mite populations are particularly heavy this spring. Therefore, it is absolutely essential that good rust mite control be obtained, if early injury is to be prevented. If dusts are to be used it is suggested that a very careful check be made about 10 days after the first dusting. If very many mites are still present, a second dust application should be made. Particular care should be used in spraying so that one sulfur application will do a very thorough and exact job. Otherwise rust mite comeback may be rapid.

Grasshoppers

Very few bird grasshoppers were present during the fall of the year,

and it is not anticipated that heavy populations will be present in very many places. However, a few groves will probably be injured this spring: The best prevention for grasshoppers at this time is absolutely clean cultivation. This means the removal of all cover crop at this time. For growers in Hillsborough, Polk and Hardee Counties where grasshoppers have been experienced during the past several years, it is strongly recommended that thorough discing be accomplished at this time. Hatching will probably begin in the middle to the last of March and groves should be clean by that time.

Aphids

Aphids are present on much of the new foliage as it has appeared in February. In young groves and on Temple orange, some growers may wish to use sprays for aphid control. Several possibilities are suggested. The old standby is nicotine sulfate at one pint per 100 gallons of spray plus either lime-sulfur or wettable sulfur. TEPP may be used as a substitute for nicotine. Since the emulsions offered for sale are at more than one dilution, it is suggested that the manufacturers recommendations be followed as regards dosage. Parathion may be used at 1 pound of 15 percent wettable material per 100 gallons of spray. This should give satisfactory aphid control. Do not use parathion, if fruit is to be harvested within 30 days. On non-bearing trees benzene hexachloride may be used at the rate of 2 pounds of a 6 percent gamma isomer material per 100 gallons of spray. Under no circumstances should this spray be used where fruit is on the trees. In all cases it should be remembered that in order to control aphids the spray must be timed in such a way that the aphids will be killed before excessive leaf damage has been accomplished. As leaves begin to harden up, the aphids will grow wings and leave. Aphid control is useless by that time. A rather rapid comeback of aphids is often noted after the use of any aphicide. Prolonged control cannot be obtained with any of the materials suggested, as new aphid populations can move in from adjacent groves. However, the major part of the leaf injury can be prevented by the proper timing of a single spray application.

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Reports Of Our Field Men . . .

NORTH CENTRAL FLORIDA
V. E. (Val) Bourland

We reported several days ago that melons were slow in getting started due to the extremely dry weather, and since that time we have been able to intercept this information and we now report that most of the melon acreage has been very badly damaged by frost. This means new plantings and with new plantings it means that the south Florida, middle Florida and central points in north Florida will have melons on the market at the same time. This is a bad situation. As of this writing weather continues dry with lots of irrigation being done. Growers that have made fall plantings of new trees have had to water constantly. We have moved most of our mid-season fruit with late bloom tangerines being in demand at this time. We have a considerable tonnage of grapefruit that will not pass maturity standards, but some of this is being picked. Valencia oranges are beginning to move to market. Prices have been very satisfactory. Where we have been able to get moisture we are getting a very nice bloom and plenty of new growth.

POLK COUNTY
J. M. (Jim) Sample

We feel that the cool weather during the middle to latter part of February was beneficial to our crop of citrus fruit remaining on the trees. That is all we have to say about the cold spell, but we are still bemoaning the fact that for the second year in succession we are having a disastrously dry spring season that is bringing disaster to the many individuals that are not equipped to irrigate their groves. At this time it appears to us that a thorough irrigation system should be considered as standard equipment on any grove property. Growers throughout this section have done an excellent spray job thus far this year and they are expecting to follow through during the remainder of the season. We all know that prices have been very good and we expect to see them hold up all during the season.

HILLSBOROUGH & PINELLAS COUNTIES
C. S. (Charlie) Little

The groves in this section are still very dry and everyone with irrigation equipment are running it around the clock. In Pinellas County where we have been irrigating for several weeks the wells are getting very salty. We have never seen as heavy droppage as we are having at this time on valencia oranges and grapefruit. In many groves you can see the area under the tree completely covered with fruit. With prices as high as they are at this time this droppage is a blow to the grove owner. Rust mite and red spider are continuing to be very active and we are advising our growers to spray with copper oil as soon as weather and tree conditions permit. Fruit buyers are covering the territory in an effort to buy Valencias and grapefruit. Some growers are selling and others are holding their fruit to see what the trend of the market will be. During the last two or three years we have been growing a considerable acreage of watermelons, and this year the average had been increased. In many instances we had melons that had started to run, but the February frosts practically wiped them out.

WEST CENTRAL FLORIDA
E. A. (Mac) McCartney

The recent cold spell did some damage to tender truck crops all over this territory. In fact all of the late plantings were completely wiped out unless they were well protected by one means or another. Some new plantings will be made, but definitely the acreage will be less than at first anticipated. Citrus properties are in excellent condition and a proper spray and cultural program is being followed to insure a quality crop of fruit for the coming year. We have fertilized most of our citrus properties in anticipation of an excellent bloom and hope that our expectations will be reflected in an enormous crop during the coming season. I don't believe that we get all of the good and I don't believe that we get all of the bad, so if we will all stick together we will take the good and the bad, and in the end we will all realize that Florida farming is profitable.

SOUTHWEST FLORIDA
Eaves Allison

Citrus prices have again hit the top and the big news this season has been the very satisfactory returns to growers. Nobody has heard anything in a long time about the drastic early season laws which kept the green fruit off the market for the first time in our history. The many screams of anguish at that time about how the green fruit hanging on the tree would ruin the industry don't seem to have much basis in fact. Keeping the green fruit on the tree until fit to eat seems to have paid off everybody except the man who wanted to buy it for fifty cents or less. Citrus bloom is normal this year, early—as in the old regular days and apparently plenty heavy to insure a good crop if the rains come along. Drouth conditions are very serious with many groves that have not irrigated in a dead wilt.

SOUTH POLK, HARDEE AND HIGHLANDS COUNTIES
R. L. (Bob) Padgett

In spite of the most severe drought for this time of year that this section has ever had, many groves look good, but hundreds look bad. Those that have had ample irrigation look splendid and are full of new growth and bloom. The time has now arrived in this territory that irrigation equipment should be considered as a necessary standard. Many of us thought to the contrary a few years back but this writer will concede that a citrus grower must have his own irrigation equipment or the facilities of his neighbor if he is to expect profitable results from his grove. We have had our run of red spider and purple mite this spring and the damage has been greater from these pests than in many years. The continued dry weather has been a contributing factor to this pest damage. Our topdresser program is in full swing now and will be completed in early March. Growers will soon get underway with their post bloom spray.

Weather conditions hasn't been working to the best interests of the fruit and vegetable growers of Florida here of late. The vegetable growers had some damagin' results from frost early in the Fall and then after several months of warm weather we had killin' frosts in February. Citrus growers was menaced because the high temperatures caused heavy droppage and made quality fruit hard to mature. Dry weather the past several weeks made these difficulties worse.

On the other hand they is a feelin' of optimism among fruit growers of the state and because of this we expect to see one of the highest quality crops Florida has ever marketed during the comin 'season. Practically all growers has gone the limit in sprayin' and fertilizin' so as to have not only the finest quality but one of the largest crops this state has ever produced.

With the amazin' development of concentrate in the state growers are urged to produce sufficient fruit to care for the demand and with the concentrate folks settin' high standards for the quality of their products as they should do, the growers realize that if they are to market their fruit on a profitable basis they must produce fruit of excellent quality.

Dry weather has hurt the quality of our fruit and durin' the past two years the dry weather has convinced most growers that they must plan to be equipped with a good irrigation system. The expense of such a plant will soon be taken care of by better quality which means higher prices and more boxes per tree.

A lot of growers, processors and shippers has told us they can't be positive about the future citrus prices for the remainder of the season, but yesterday a prominent shipper in Orlando said he thought there might be a little decline in the orange market in the next few weeks, but he looked for the market to strengthen and about the first of May to get stronger with prices to be higher than at present.

We was talkin' to a good Lyons Fertilizer customer in Orange county a few days ago and he told us he sold the Marsh seedless grapefruit from one and three-quarters acres for $4000 in bulk and, that ain't hay in anybody's language. No wonder there is such a demand for citrus acreage in Florida.

Uncle Bill

Can America Prevent A Deadly Invasion?

BY KOJI ARIYOSHI

LESS than 12 hours by air from California, a devastating invader—the Orential fruit-fly—is trying to slip through a blockade from Hawaii into continental United States. If the invasion succeeds, fruit and vegetable growers and distributors from California to Florida will confront a formidable and costly enemy.

The blockade consists of a rigid inspection program by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture. But the invasion need not be on a mass scale. If one or two fruit flies successfully could sneak away as stowaways and get past the inspectors, there soon would be an army sweeping across America's richest agricultural areas, especially the frost-free regions.

The Orential Fruit Fly already has caused milloins of dollars worth of damage to the fruit, vegetable and flower industries of the Hawaiian Islands. It is more devastating than the Japanese beetle, the melon fly, or the Mediterranean fruit fly. What the Oriental fruit fly **can do** to American agriculture was demostrated back in 1929 when 30 banks in Florida in as many days closed down because the Mediterranean fruit fly destroyed the citrus crop. Florida farmers stripped fruits from trees in fly-infested orchards. Some even chopped down their trees. It cost more than $10,000,000 merely to control the pest, which entomologists characterized as "probably the most deadly of all enemies of tropical and semi-tropical fruits."

But that was before the discovery in this hemisphere of the Oriental fruit fly, or **Dorcus dorsalis,** which is extremely tough and even "bumps off" the Mediterranean fruit fly. An etomologist recently won a rebuke from one of his brethren by saying the Oriental fruit fly is "rather pugnacious." Actually, it is a deadly enemy of other flies, attacking the fellow-flies on the same fruit. Some scientists feel this battling among larvae accounts for the decrease in the Mediterranean fruit fly population in Hawaii in recent years.

Dozens of fruits which are susceptible to the Oriental fruit fly can be named. Observation has shown that the fly is most partial to peaches, apricots, plums, oranges, lemons and grapefruit. It even attacks cotton bolls.

This means that peaches in Georgia, the growing grapefruit industry in Texas, oranges, peaches and various other fruits from the West Coast to the East Coast daily are threatened as long as the fruit fly grows and multiplies on the sunny Hawaiian Islands.

In Honolulu's supermarkets, even grapefruits and tomatoes imported from the mainland are stung and infested by the female flies before being sold to customers.

Hawaii has been forced to live with other pests, like the Mediterranean and melon fruit flies because the cost of controlling them was too high for the amount of damage they were inflicting. The melon fruit fly has been infesting Hawaiian fruits ever since 1895, and the Mediterranean fruit fly since 1920, but the pugnacious, hard-stinging Oriental may prove to be the straw that breaks the camel's back for the island's new and aspiring flower and produce industries.

This latest deadly enemy sneaked into Hawaii during the war—on planes or troop ships. Its presence was discovered first in 1946, when a peach grower on the cool slopes of Haleakala noticed that a new type larvae were eating their way into his fruits through juicy, delicious tissues. Although he never had sprayed before, he began spraying to kill this newcomer. But even with the spray, up to 100 per cent of his crop was infested, he excitedly reported to the government entomologists.

Since that date, the Oriental fruit ,fly, like a dread invasion, has taken over the fresh fruit industry of Hawaii. There now is scarcely an orchard that does not know the sting of this deadly invader.

How much damage in dollars has the Oriental fruit fly done to the island economy? You can ask this question from district to district and from island to island, and get estimates of several million to hundreds of millions, depending on how one calculates. Sad-faced farmers shake their heads and look despondent at the future, and some point to the mountainside where wild fruits grow in lust abundance. There, they say, the flies will multiply, even if sprays are used over cultivated fields.

"No one really knows how much damage the Oriental fruit fly has caused here in the islands," Dr. H. A. Bess, station entomologist of the University of Hawaii Agricultural Experiment Station, says after making numerous trips to the various islands, looking over the farms and talking to the producers.

Dr. Bess, who says very little is known about the new invader, estimates the fruit fly has cost Hawaiian agriculture millions of dollars in the actual prevention of crop itself and the potential damages caused as far as future development of markets for island-grown fruits and vegetable, not to speak of crops already ruined. If there is no fruitfly, he says, export of Hawaiian produce can be developed without Mainland embargo to worry about.

The shock of a Mainland embargo jolted the people of Hawaii this year just when the Territorial legislature was in session. On March 23, the U. S. Bureau of Entomology

Koji Ariyoshi, editor of the weekly **Honolulu Record**, Honolulu, T. H., served as an officer in the American Army in the Far Pacific during World War II.

and Quarantine slapped a ban on Vanda orchid shipments to the continental United States from Hawaii. The reason—discovery of eggs and larvae of the Oriental fruitfly in the sweet-smelling, open Vanda blossoms. Up to then orchid growers had been saying that a $25,000,000 annual flower export business for the Hawaiian Islands was just around the corner. Vanda makes up about 70 per cent of all orchid exports because it is the most durable and can withstand long flights to Mainland cities. Its embargo meant a virtual freeze of orchid shipment from Hawaii.

Hard-hitting Thelma Akana, only woman in the Territorial upper house, in an imaginative mood told her colleagues when the Vanda embargo was first announced that Hawaii should file a $2,000,000 war damage claim for losses resulting from the fruit fly.

"Hawaii has been injured by the fruit fly just as surely as if bombs had been dropped," she said. "The fruit fly came to Hawaii as a direct result of the war."

Her colleague, Senator Herbert K. H. Lee, brilliant Chinese American lawyer, pointed out that the Oriental fruitfly invaded the islands when Hawaii's ports were under military control. The $200,000 appropriation by the Territorial legislature was negligible and will not control the pest. Florida, he said, received $50,000,000 from the federal government for a similar project when the less harmful Mediterranean fruitfly attacked the citrus crop. The Territory finally asked Congress for $2,000,000 and Congress by latest report had trimmed the amount down to $450,000.

People in Hawaii are saying. "How come" men like Senator Richard B. Russell of Georgia, head of a Senate agricultural subcommittee, would let the House members trim down the Senate recommendation of $800,000 for combatting the fruit fly. This seems incredible to islanders who know that the flies attack cotton bolls and can cause untold damage.

The boll weevil caused hundreds of millions of dollars damage to cotton formers in the South and it took 10 years for the federal and state governments to learn how to control the pest. But why wait until the flies begin spreading from state to state?

Fruit-growing California realizes the potential devastation that a single fly or live eggs and larvae

slipping through the blockade can bring to the state. The California legislature has earmarked $165,000 as a defense fund against the fruit fly attack, and it has sent State Senator Fred Weybret and a group of top men in the field to Hawaii to investigate the fruit fly problem. The Territory of Hawaii is spending more than $100,000 annually and this does not include inspection service and experiments in treating export products.

According to a rough estimate by Dr. Bess, research alone will cost more than a million dollars. Quarantine and other expenses require additional expenditure.

Although California realizes the deadly threat, experts say that Florida has a climate more similar to the Hawaiian Islands than California. Frost-free areas, like Southern Texas where grapefruit production has been stepped up, would be hardest hit by the Oriental fruitfly.

How to keep the fly from invading the Mainland is the primary problem today. Exporters in Hawaii are using fumigation, gas, heat treatment and the like to make shipments of fruits, vegetables and flowers to the Mainland possible. The difficulty is the development of methods to kill insects in fruits and flowers and leave them unharmed.

"There is a delicate balance," explains Dr. Bess, for the fruit fly larvae are living and so are plant tissues. The killing of one by heat, for example, must be done so that the plant is not damaged.

Thus far no sure treatment has been found for bananas so that this tropical fruit can be shipped for Mainland consumption. Papaya, a delicious breakfast fruit, can be treated for export but the heat treatment damages a lot of the fruit, therefore, the process is not profitable. What's interesting is that the heat itself does not damage the fruit. It stimulates the disease oragnism, like spores of fungi, in papaya and causes the fruit to rot. Here the fruitfly larvae can be considered innocent.

Because pineapple is canned for export, the embargo on fresh pineapple does not affect the industry. But the Oriental fruit fly is causing damage out in the fields where its sting in the hard skin leaves a hole for bacteria to enter. The bacteria causes the fruit to sour.

Treatment of produce for export must be accompanied by a continuous campaign to exterminate the fruitfly. As long as the fruitfly menace remains in Hawaii, the danger of its hopping to the Mainland remains.

For instance, at the Honolulu airport up to eleven Oriental fruit flies have been found resting inside the planes before their departure for the West Coast. Yes, of course, the planes are fumigated and every precaution is taken, but the threat of an invasion is not removed while the flies keep multiplying.

At present two phases of the plan of combatting the Oriental fruit fly is being conducted in the Territory, with the University of Hawaii as the research unit. The first is chemical, which includes fumigation, spraying and dusting, which will be expanded; and biological, which is the fighting of fruit flies through parasites introduced from abroad.

The Territorial Board of Agriculture and Forestry really initiated the parasite introduction work. It sent two men to the Philippines who returned with little success because of civil warfare. Later one scientist was sent to Malaya and he was transferred to Australia. From Malaya he sent half a dozen species from which two were bred and liberated in the field. One of these, **Opius longicaudatus,** has been bred by the thousands and is now quite abundant in several localities on the island of Oahu.

"Looks like this species will be of value to us," commented Dr. Bess, who said that the job of getting parasites is "really a search."

Two more men from Hawaii are now in India, sending in all kinds of parasites so that some will begin attacking the deadly fly.

To the people of Hawaii who are concerned by the mass breeding of parasites that is going at the Board of Agriculture situated in Honolulu, Dr. Bess has a reassuring answer:

"Parasites do not eat fruit but eat fruit fly, consquently they will not later become a pest of fruits. Parasites are not vegetarians."

The parasite that might save billions of dollars might already be in Hawaii, quietly carrying on the battle against the fruit fly, or it might be in deepest Africa waiting to be trapped and shipped to Honolulu.

In the meantime the deadly enemy is trying to cross the ocean, and only effective chemical treatment and vigilance can keep it from crashing through the blockade.

FIFIELD TO HEAD U. OF F. FARM EXPERIMENT STATION

William M. Fifield has been named director of the University of Florida Agricultural Experiment Station, succeeding Harold Mowry, who retired Jan. 31.

His appointment, effective March 1, was approved by the State Board of Control, following recommendation by Provost J. Wayne Reitz and President J. Hillis Miller.

Fifield has been acting director since Mowry's retirement. He has been assistant director of the station since July 1, 1941, but was on military leave of absence from March 8, 1942, to Dec. 31, 1945.

CITRUS GROVE RETURNS ABOVE OPERATING COSTS BY SEASONS, 1931-48

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when there were not groves operating in the red (Table 2 and Chart 2). There were no seasons when each mixed grove returned its operating costs, but there were 3 seasons when each orange, and 4 seasons when each grapefruit grove returned its operating costs. The highest proportion of groves operating in the red for any season was 50 percent for orange, 66 percent for mixed, and 100 percent for grapefruit groves. The 17-year average for orange groves was 17 percent, mixed 21 percent, and grapefruit 33 percent. This means that over this period there was one out of 6 orange groves that operated in the red, one out of 5 mixed, and one out of 3 grapefruit groves. There were 5 seasons when in excess of 33 percent of the orange groves failed to return operating costs. Similarly, there were 4 seasons in the case of mixed and 9 seasons in the case of grapefruit groves when in excess of 33 percent failed in this regard.

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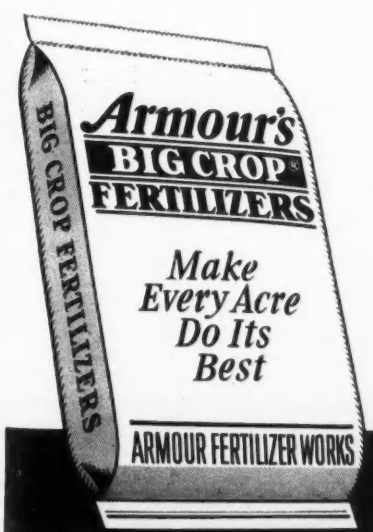

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